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A Review

Amnion In Dentistry - A Review

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Abstract
The amnion is a membrane building the amniotic sac that surrounds and protects an embryo. The amniotic membrane is a tissue of fetal origin and is composed of three major layers. Amnion allograft has been used in the field of medicine for its exceptional wound-modulating properties. However, in the field of dentistry, only a limited number of reports have explored its potential in healing of oral wounds.

Key Words
Amniotic membrane, Tissue Engineering, Periodontics

Introduction
Periodontal diseases leading to deterioration of tooth-supporting structures are a serious concern for clinicians. Spatially directed regeneration of periodontal tissues through manipulation of cell fate pathways is referred to as guided tissue regeneration (GTR). The technique involves the use of a semipermeable membrane underneath the gingiva pre- cluding downward regeneration of gingival epithelium along root surface while maintaining the space for regeneration ofperiodontal ligament and establishment of connective tissue attachment.[11] The clinical application of amniotic membrane for guided tissue regeneration while fulfilling the current mechanical concept of GTR, amends it with the modern concept of biological GTR.[12] Though the amniotic membrane has been used in general surgery for a long period of time, its use in dentistry particularly in periodontal surgeries is only new to us. Very few studies have been done so far. [1]

Periodontal diseases leading to deterioration of tooth-supporting structures are a serious concernfor clinicians. Spatially-directed regeneration ofperiodontal tissues through manipulation of cellfate pathways is referred to as guided tissue regeneration (GTR). The technique involves the use of a semipermeablemembrane underneath the gingivaprecluding downward regeneration of gingival epithelium along root surface while maintaining the space for regeneration of periodontal ligament andestablishment of connective tissue attachment[2]. Amniotic membrane is a composite membrane consisting of pluripotent cellular element embedded in a semipermeable membranous structure [3],[4]. It has been shown that amniotic membrane is an immunotolerant structure [5]. Meanwhile, the existence of pluripotent stem cells possessing the ability of trans differentiation to other cellular elements of periodontium makes it a suitable candidate for GTR. Excellent revascularization of the amniotic membrane is another favorable property of this natural structure [6].
The clinical application of amniotic membrane for guided tissue regeneration while fulfilling the current mechanical concept of GTR, amends it with the modern concept of biological GTR. Biomechanical GTR proposed herein using amniotic membrane, not only maintains the structural and anatomical configuration of regenerated tissues, but also contribute to the enhancement of healing through reduction of post-operative scarring and subsequent loss of function and providing a rich source of stemcells. In line with our proposal, it has been demonstrated that amniotic membrane enhances gingival wound healing properties and reduces scarring [6].

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Structure Of Human Amniotic Membrane
The human placenta is a complex organ that is very important for the development and survival of the fetus throughout the gestation. It is about 10-15 micrometers thick and consists of two fetal membranes; the inner amniotic membrane and the outer chorion. The AM encases the amniotic fluid and fetus, and is highly flexible because of which it is easily be separated from the chorion. The membrane is composed of multiple layers which include a single layer of epithelial cells, a basement membrane and an avascular connective tissue matrix.[8] **[Fig. 1]**

Applications:
The use of placental tissue for the treatment of wound started more than 100 years ago when by Davis in 1910 first used these fetal membranes as skin substitutes for the treatment of open wounds. Later these membranes were also used for the treatment of burn and repair of conjunctiva defects and as a dressing of chronic ulcers. In 1965, Dino et al. demonstrated for the first time that amniotic membrane could be separated, sterilized and safely used at a later date. Since then a lot of research has been initiated to understand the true regenerative potential of this membrane.
Amnion tissue contains growth factors that may aid in the formation of granulation tissue by stimulating fibroblast

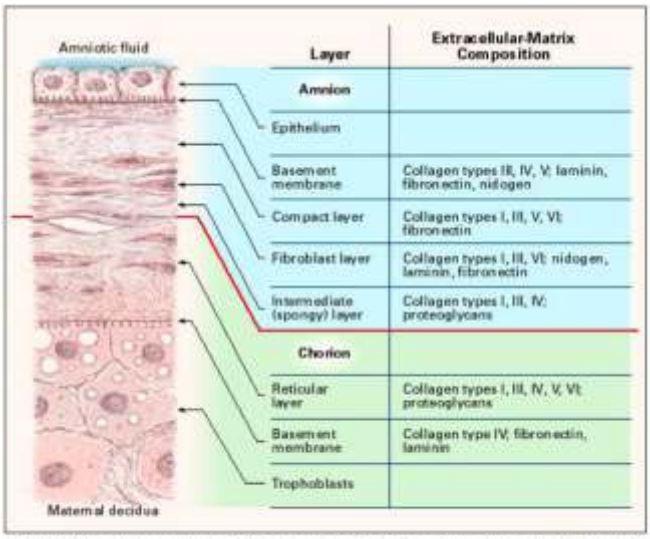

Figure 1: Schematic presentation of the structure of the foetal membrane at term. The Extracellular matrix components of each layer are shown. Adapted from Parry and Strauss (1998); with some modifications.

growth and neovascularization. In addition, the cells found within tissue exhibit characteristics associated with stem cells and may enhance clinical outcomes.

Amnion has shown an ability to form an early physiologic "seal" with the host tissue precluding bacterial contamination and multiple studies support amnion's ability to decrease the host immunologic response via mechanisms such as localized suppression of polymorphonuclear cell migration.

The use of amniotic membrane is a novelty in the dentistry field, as it reduces the drawbacks of other materials.

An important component of tissue engineering (TE) is the supporting matrix upon which cells and tissues grow, also known as the scaffold. Scaffolds must easily integrate with host tissue and provide an excellent environment for cell growth and differentiation. Most scaffold materials are naturally derived from mammalian tissues. The amniotic membrane (AM) is considered an important potential source for scaffolding material. The AM represents the innermost layer of the placenta and is composed of a single epithelial layer, a thick basement membrane and an avascular stroma. The special structure and biological viability of the AM allows it to be an ideal candidate for creating scaffolds used in TE. Epithelial cells derived from the AM have the advantages of stem cells, yet are a more suitable source of cells for TE than stem cells. The extracellular matrix components of the basement membrane of the AM create an almost native scaffold for cell seeding in TE. In addition, the AM has other biological properties important for TE, including anti-inflammatory, anti-microbial, anti-fibrosis, anti-scarring, as well as reasonable mechanical property and low immunogenicity.

One of the oldest biomaterials used for scaffolds is the foetal membrane. The foetal membrane was first used for the transplantation of skin in 1910[9]. Subsequently the foetal membrane was found to be useful in the management of burns; creation of surgical dressings; as well as reconstruction of the oral cavity, bladder, and vagina; tympanoplasty; arthroplasty and so forth.[10] Specifically, the amniotic membrane (AM) has gained importance because of its ability to reduce scarring and inflammation; enhance wound healing; and serve as a scaffold

Reference	The AM component	Species	target cell/tissue
Azuara-Blanco *et al*., 1999	Cryopreserved AM	Human	Eye
Chen *et al*., 2000	Cryopreserved AM	Human	Eye
Davis, 1910	Intact AM	Human	Skin
Ishino *et al*., 2004	Denuded AM	Rabbit	Eye
Jin *et al*., 2007	Intact/Denuded AM	Rabbit	Cartilage
Kosuga *et al*., 2000	AECs	Mouse	beta-glucoronidase secretory cell
Mligiliche *et al*., 2002	Denuded AM	Rat	Peripheral nerve
Mohammad *et al*., 2000	Denuded AM	Rat	Peripheral nerve
Takashima *et al*., 2004	AECs/Intact AM	Mouse	Hepatocyte
Tsai *et al*., 2007	Cryopreserved AM	-	Endothelial cell
Tseng *et al*., 1998	Cryopreserved AM	Human	Eye
Ucakhan *et al*., 2002	Nonpreserved AM	Human	Eye
Yang *et al*., 2006	Denuded AM	Mouse	Skin

for cell proliferation and differentiation as a result of its anti-microbial properties. In addition, the ECM of the AM and its components, such as growth factors, suggest that the AM is an excellent candidate to use as a native scaffold for TE. In addition, the AM is a biomaterial that can be easily obtained, processed and transported.

Summary of potential applications of the amniotic membrane scaffolds for different tissues in animal or human studies. [11]

Conclusion

The preserved human amniotic membrane is a novel tissue engineerined biomaterial that is recently tried in field of medicine and dentistry to regenerate the lost tissues and acceler- ate repair.[8] The clinical application of amniotic membrane not only maintains the structural and anatomical configuration of regenerated tissues, but also contributes to the enhance- ment of healing through reduction of post-operative scarring and subsequent loss of function and providing a rich source of stem cells.[7] However, further research and long term clinical trials investigating the full potential of this stem cell reservoir are still warranted to strengthen the fact amniotic membrane is indeed a reservoir for regeneration.[8]

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